

What is claimed is:

1. An evaporative burner for combusting fuel from a fuel supply and air from an air supply, the fuel and air combined to form a fuel-air mixture, the evaporative burner comprising:

- 5 a. a swirler for feeding air into the burner;
- b. an evaporation chamber connected to the swirler for receiving air and fuel, the evaporation chamber including a socket for accommodating an igniter assembly, the evaporation chamber characterized by inside walls;
- c. an igniter assembly coupled to the evaporation chamber, the igniter including an air port and a fuel port, the assembly for igniting the fuel-air mixture in the evaporation chamber; and
- d. a reverse throat coupled to the evaporation chamber with raised ends, the raised ends reaching into the evaporation chamber.

15 2. The evaporative burner of claim 1, wherein the raised ends of the reverse throat stabilize a flame near the evaporation chamber walls.

3. The evaporative burner of claim 1, further comprising a recuperative heat exchanger.

20 4. The evaporative burner of claim 1, further comprising a combustion chamber coupled to the evaporation chamber by the reverse throat for receiving a flame from the evaporation chamber.

25 5. The evaporative burner of claim 4, further comprising a flame rectification monitoring device.

6. The evaporative burner of claim 4, further comprising a recuperative heat exchanger.

7. The evaporative burner of claim 1, the swirler including vanes.

30 8. The evaporative burner of claim 7, wherein the swirler includes at least eight vanes.

9. The evaporative burner according to claim 1, wherein a porous metal lines the inside walls of the chamber.

5 10. The evaporative burner of claim 1, wherein the igniter assembly comprises:

- a. a material lining the interior of the assembly, wherein the material distributes the fuel throughout the assembly; and
- b. an excitable igniter for igniting the fuel-air mixture in the assembly to form a flame.

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11. The evaporative burner of claim 10, wherein the material lining the interior of the igniter assembly is a screen.

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12. The evaporative burner of claim 1, further comprising a fuel temperature varying means coupled to the burner.

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13. The evaporative burner of claim 1, wherein the dimensions of the igniter assembly air port are correlated to the dimensions of the reverse throat and swirler, to balance the air flow through the igniter assembly air port and the air directed by the swirler such that a Fuel-Air Equivalence ratio from about 2 to about 6 is achieved in the igniter.

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14. The evaporative burner of claim 1, wherein the dimensions of the igniter assembly air port are correlated to the dimensions of the reverse throat and swirler, to balance the air flow through an igniter assembly air port and the air directed by the swirler such that an exiting velocity of a flame from the igniter into the evaporation chamber is between about 40 to about 120 cm/sec.

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15. An evaporative burner engine system including the evaporative burner of claim 6, further comprising an external combustion heat engine.

16. An evaporative burner engine system including the evaporative burner of claim 6, further comprising a Stirling cycle engine.

5 17. An evaporative burner engine system including the evaporative burner of claim 1, further comprising an external combustion heat engine.

18. An evaporative burner engine system including the evaporative burner of claim 1, further comprising a Stirling cycle engine.

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19. A method for stabilizing a flame in an evaporative burner, the burner including an evaporative chamber and an igniter assembly coupled to the chamber, the method comprising:

- a. providing a reverse throat with raised ends reaching into the evaporative chamber for retaining the flame in the chamber;
- b. supplying fuel and air to the chamber; and
- c. igniting the flame in the chamber using the igniter assembly, the flame evaporating the fuel.

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